An Empirical Assessment of House Price Adjustments on Aggregate Consumption

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Paper Prepared for

The Australasian Macroeconomics Workshop

Australian National University, Canberra

15-16 April 2004

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Abstract

This study measures the effect of changes in net housing and financial wealth on household consumption. The link between consumption, income and net wealth is measured within a Dynamic Ordinary Least Squares and a Dynamic Generalised Least Squares framework for the period Q2:1988-Q1:2003. It is found a permanent one dollar rise in housing wealth leads to a six cent increase in consumption, three times the effect of a one dollar rise in net financial wealth. A policy experiment is conducted to quantify the effect of a fall in house prices on aggregate consumption. The house price fall is defined as the price movement required to realign house prices to a steady state valuation using a price-to-rental yield indicator. If the required house price re-alignment were to occur over one year, it is estimated that household consumption would fall by 4.1 to 10.6 per cent.

Keywords: wealth effect, consumption, housing wealth, financial wealth, price-to-rental ratio.

JEL: E21

1. Introduction

The wealth effect – the impact of changes in household wealth on private consumption – has received unprecedented attention of late. The surging interest reflects the significant increase in household wealth in Australia and a number of other OECD countries over the past decade as a result of sharp rise in financial and housing asset prices and growing levels of household debt. A key question remains: If current asset prices are not sustainable, what is the likely impact of an abrupt correction in asset prices on household consumption and, thus, the wider economy?[1]

There are a number of reasons why wealth is increasingly important in the assessment of demand conditions and thus policy decisions.[2] Firstly, relative to income and other determinants, asset prices have become increasingly important over time as a determinant of consumer spending. Secondly, financial deregulation and innovation have compounded the relationship between asset prices and consumption. Thirdly, the aging of population in industrialised countries, including Australia, means that an increasing proportion of households will finance their consumption with asset holdings. Fourthly, perhaps more for financial assets than for housing assets, asset prices across countries seem to be increasingly synchronised and, thus, have a bigger role in the international transmission of business cycles. Lastly, a large marginal propensity to consume out of wealth means that an asset price boom will lead to a significant rise in

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[1] There has been a significant amount of public debate on the rate of house prices rises in Australia. The International Monetary Fund (IMF 2002; IMF 2003), the United States Federal Reserve Bank (Gramlich 2002) and the Reserve Bank of Australia (RBA 2003a) are among a number of policy bodies that have expressed concern over the rate of house price appreciation.

[2] This part is drawn on IMF (2002)and Senhadji *et al.* (2003).

household consumption for a given income level. This will lower the private saving rate and, thus, have ramifications on the country's balance-of-payment position.

The objective of this paper is, first, to estimate the effect of changes in housing and financial wealth on household consumption using Australian data; and second, to simulate the impact of a correction in house prices on aggregate consumption. The correction in house prices is estimated based on the long run price-to-rental (PR) ratio in the Australian housing market.

This study has a strong focus on house wealth. This is because (a) dwellings typically represent the most valuable single asset owned by Australian households; (b) households can increasingly access to home equity; and (c) the recent upward movement in house prices has stirred up concerns amongst policy makers.

Resulting from the house price appreciation, untapped equity in the housing stock is very large and the capacity to access it is growing due to increasing access to innovative products like home equity loan (Stevens 2003a). If households were to access even a small part of the equity built up over the past five years, it would add a considerable amount to their purchasing power. Furthermore, innovative products like home-equity loans and mortgages with a redraw facility have loosened households' liquidity constraints and enabled consumption to be more responsive to changes in future income and wealth expectations. In addition, transaction costs associated with home equity withdraw have fallen dramatically due to product innovation and financial competition and widened the means of borrowing available to households, which, in turn, may imply a greater propensity of consumption out of housing wealth than out of accumulating other types of credit.

The increasing influence of housing wealth on household consumption behaviour is clearly reflected in the rapid structural change of household balance sheets. The average rise in net wealth of Australian households amounts to 11 per cent per year since 1996, which is equivalent to nearly 95 per cent increase in current income (Stevens 2003b). Much of the increased wealth has been in the form of dwellings. In fact, since 1997, the Australia-wide median price for an established house has doubled. At the same time, household debt has jumped from just over 50 per cent of disposable income in 1990 to about 125 per cent by the end of 2002 (Senhadji, Ramakrishnan et al. 2003). Along side with the US and the UK, Australian households have one of the highest debt to income ratios amongst industrialised countries.

As pointed out by Stevens (2003a; 2003b), the full ramifications of this structural change in household behaviour and balance sheets has yet been revealed. Firstly, a much larger balance sheet means that changes in wealth become more important relative to changes in current income in determining the course of household spending over the business cycle. Secondly, higher leverage means that negative shocks to income are more likely to be amplified as they work their way through the economic system. Lastly, higher leverage may also reinforce the asset price channel of monetary policy, especially when the majority of Australian household debt is at floating rates.

While such domestic background provides a strong motivation to look at the Australian case, this study is equally relevant to many other industrialised countries. A number of OECD countries, such as Ireland, Britain, Spain and the US have also experienced a rapid rise in property prices in recent years as the world wide trend of lower interest rates have made mortgage loans more affordable. At the same time, financial

innovations have greatly increased housing asset liquidity in these countries. Indeed, as shown later, our empirical results mirror some other studies using international data.

This study contributes to a handful of recent studies on this topic using Australian data, including Tan and Voss (2003), Dvornak and Kohler (2003) and Senhadji *et al*. (2003). An innovation of this study is the simulation of the effect of house price realignment on household consumption under various scenarios.

In terms of empirical estimation of the wealth effect, the study follows the lead of Tan and Voss however diverges in its focuses on total household consumption instead of non-durable consumption.[3] Given the focus of this study is the examination of the impact of a fall in house prices on the wider economy, total consumption is arguably more relevant. Dvornak and Kohler's estimation procedure is different to that employed here. They used state level panel data rather than national level time series data to estimate their consumption functions, however, did not estimate any short run consumption dynamics. Senhadji *et al*. incorporated access to credit in their model in an attempt to capture the effect of financial deregulation and innovation, but excluded financial wealth. Most importantly, the findings of the above Australian studies tend to differ from various international studies, including IMF (2003) and Case *et al.* (2001). By carefully constructing series of housing and financial wealth using mortgage loan data, this study has produced robust results that are consistent with international evidence.

This rest of the study is divided into four sections. Section 2 examines the movement of house prices in Australia in the light of the price-to-rental ratio. Section 3 describes

the data set briefly. Section 4 discusses the results of econometric modelling as well as that of policy simulations; and the last section concludes.

2. Australian Property Prices

Australian property prices have grown sharply in recent years. Sydney and Melbourne prices started to rise strongly in 2001 as the demand for new housing rose alongside the Federal Government's First Home Owners Grant (FHOG) and the historically low mortgage interest rates. Attracted by the modest after-tax holding cost of investment property, investors began to enter the housing market, further driving prices upward. RBA (2003b) observed that while in principle negative gearing does not favour rental property over other assets, the heavy promotion made by the property investment seminar industry might have reinforced such a perception amongst investors.

The price rises in Sydney and Melbourne were quickly matched by rises in Brisbane and other capital cities. Figure 1 shows the extent of the rise in Australian property prices since 1984. Of particular relevance is the relatively subdued rise in prices over the majority of the sample, which is in stark contrast to the sharp rise in prices since 2001. Besides the FHOG and low interest rates, poor returns from alternative investments,[4] strong employment and high levels of immigration are likely to have also fuelled the housing market's performance in recent years.

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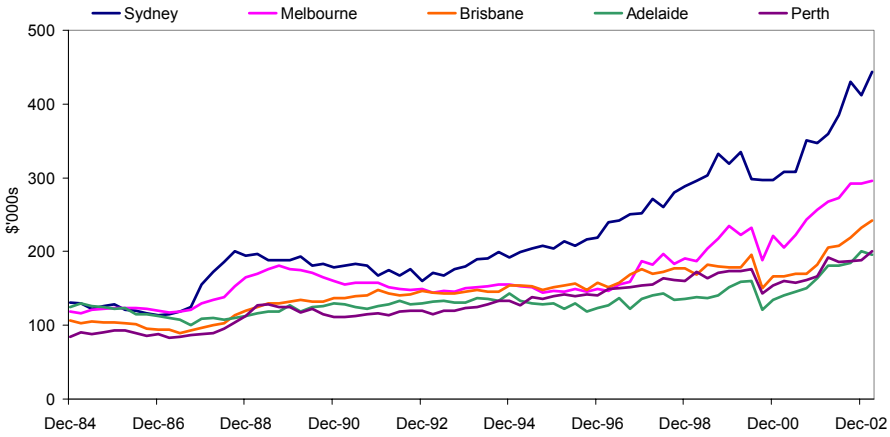
[3] Dvornak and Kohler also employed total consumption rather than non-durable consumption.

[4] Senhadji *et al.* showed that equity prices have increased at an annual average of 2¼ per cent for the three years ending 2002, compared to the 13 per cent rise in house prices.

Figure 1: Real House Prices



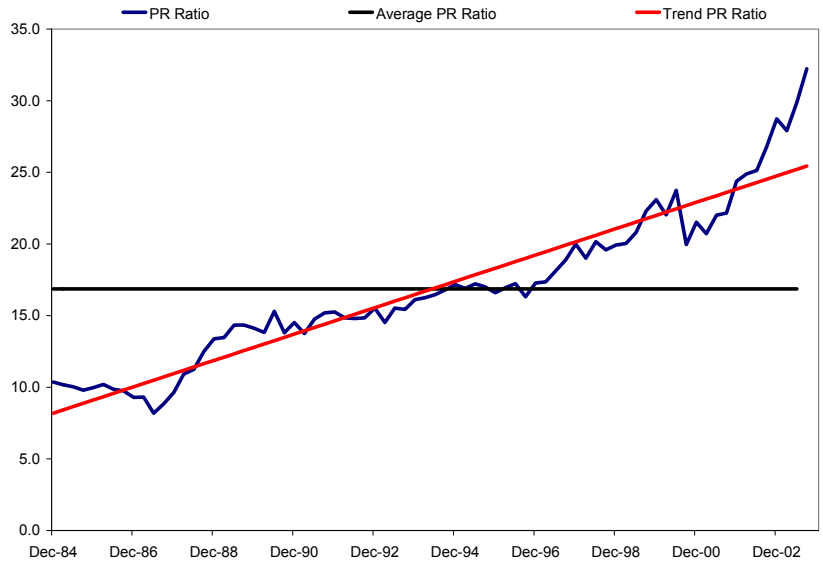
Note: House Prices have been deflated using the household consumption (1999/2000 = 100) deflator.
Source: Housing Industry Association/Commonwealth Bank of Australia (HIA/CBA) Housing Report, ABS 5206

An important policy issue is the extent to which the recent rise in house prices has been coupled with a corresponding movement in the fundamental value of housing investment. If house prices rises have not been supported by fundamental valuation, then to what extent will the current house price levels adjust downward? One instrument used extensively in finance that assists in determining investment valuation is the price to earnings (PE) ratio. A high PE ratio suggests that the stock in concern could be overvalued and its price might be expected to fall, or alternatively its earning rise, in the future. Leamer (2002) and Krainer (2003) propose that the same methodology can be applied to housing investment by measuring the present value of expected future rent. Accordingly, the PR ratio can be used to determine the long-run fundamental value of housing investment.[5]

[5] In constructing the PE ratio, the earnings stream of a stock is the gross amount of earnings the stock produces. In contrast, in the construction of the PR ratio, the rental income must be net of outlays like house repairs and land rates. For some investor properties, maintenance repair expenditure can absorb a

Figure 2 shows the PR ratio from Q4:1984 to Q3:2003.[6] Relative to house prices, average house rents in capital cities have remained steady which has caused the PR ratio to increase over the data sample. Indeed, RBA (2003b) suggested that in 2003, the cash yield of residential property in Australia was around 2½ per cent or a little lower,[7] compared to 7 to 10 per cent in other comparable countries, and 8 to 9 per cent in industrial, commercial and retail property markets in Australia.

Figure 2: Price-to-Rental Ratio



Source: HIA/CBA Housing Report, ABS3101, Author's own calculation

The first point to note in Figure 2 is the absence of any clear mean reverting tendency in the PR ratio over the data sample. This is somewhat counter-intuitive as one would

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significant part of the annual rental income. Due to data unavailability, this study does not account for rental expenditure.

[6] The national PR ratio in the figure was constructed by averaging capital city rental data, weighted by the population of each capital city.

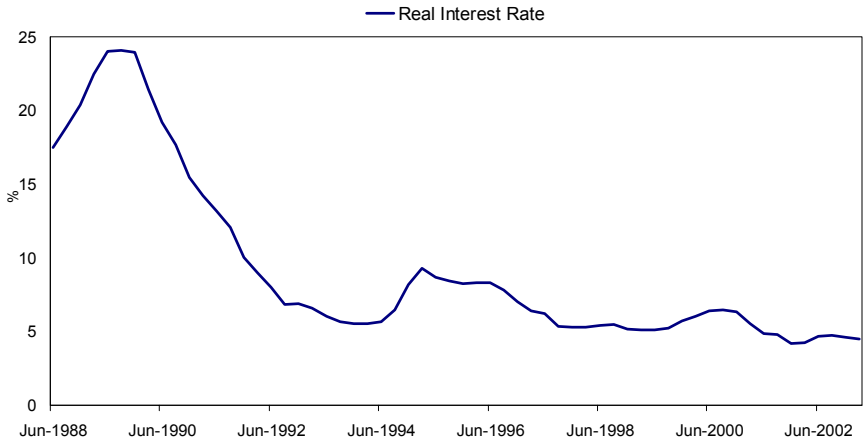
[7] Cash yield is calculated as gross rental income minus payment of municipal rates, water rates, management fees, state levies, maintenance, etc, expressed as a percentage of the property price. So it is the inverse of PR ratio.

expect that while there may be divergence from the equilibrium valuation in the short-run, it is likely to show some tendency to mean revert during the 20-year data sample. Three potential explanations for this phenomenon are suggested:

Length of the Australian housing cycle – the 20-year data set may not be representative of a complete housing cycle.

Falling interest rates – the average mortgage interest rate has decreased from 15 per cent in the second half of the 1980s to about 7 per cent in the past two years (see Figure 3).[8] Falling interest rates give rise to a higher present value of the same rental income flows and, hence, through the impact of higher asset prices, a higher PR ratio. In fact, Senhadji *et al.* find that the decline of the real mortgage rate in the past five years of 4½ percentage points alone accounted for 30 per cent of the increase in real property prices.

Figure 3: Real Interest Rate – Australia

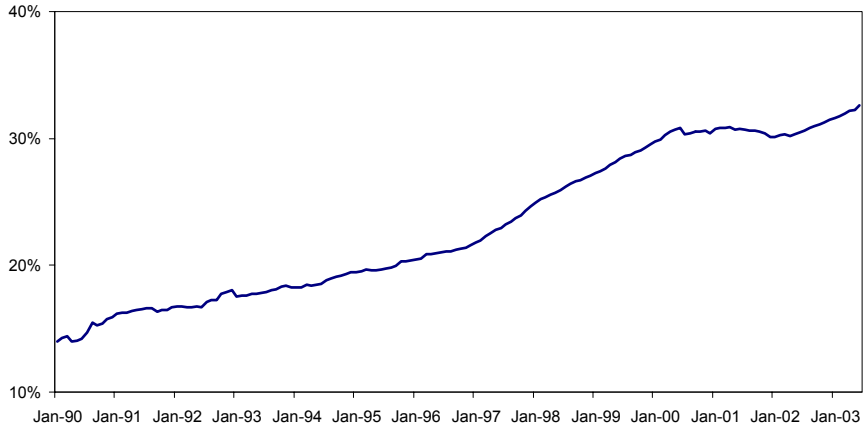


[8] According to the RBA (2003a), out of this 8 percentage point reduction, 2 percentage points results of from stronger financial competition and thus lower lender margins, while the remaining 6 percentage points relate to the structural reduction of interest rates.

Source: Reuters

Future price expectation – if there is strong expectation that the price will rise in the future, and the investment will be held for a relatively short period for the benefit of capital gain, there may be less connection between the asset price and the earnings stream. Interestingly, over the data sample examined, purchasing property for investment purposes has taken up an increasingly greater share of housing market activities (see Figure 4).[9]

Figure 4: Share of Total Bank Mortgage Lending to Investors



Source: RBA Statistical Table D02.

The first two explanations represent structural changes in property markets, while the last one points to irrational exuberance. Clearly it is the last explanation that poses a

[9] There may be bias in the data. Australian taxation laws allow a tax deduction for the interest associated with investment housing. This is likely to result in investors taking out a greater proportion of the value of their loan than owner-occupied. Furthermore, it is most probable that investors have existing collateral and hence may be subject to less stringent minimum deposit requirements. There exists no taxation advantage for owner-occupier housing investment. Partially offsetting the taxation benefit that housing investors receive is the capital gains tax that investor housing is subject to on sale.

real danger to the Australian economy if property prices were to deflate abruptly. It is the estimation of the macroeconomic impact of abrupt housing price realignment that we now turn to.

3. Data

All data used in the empirical estimation of this study are measured in real per capita terms and cover the period from Q2:1988 to Q1:2003. All data are deflated by the household consumption deflator.[10] A broad outline of the data is provided.

Consumption

Quarterly total household consumption expenditure measures the total private household consumption in Australia. Data are measured in seasonally adjusted, current price terms and quoted in $million. Empirical research on the household consumption function tends to be divided according to which type of goods are included in the measurement. This study employs the broader definition of consumption – including durable and non-durable goods.

The inclusion of both types of goods is based on (a) the expectation that households are unlikely to treat some durable goods, especially clothing, footwear and household appliances, as forms of household wealth; (b) the inaccuracies associated with reliably measuring durable good depreciation rates; and (c) the objective of the study is to measure the macroeconomic effect of a permanent change in household wealth.[11]

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[10] Deflating the housing and financial wealth variables with the household consumption deflator is to measure the purchasing power of wealth and is a common practice in the literature.

[11] Consumption functions with non-durable consumption were also estimated but the results are not reported here. The results did not differ dramatically from those reported below.

Income

Household income is the sum of primary and secondary income.[12] Primary income, which includes labour income, accounts for around 80 per cent of total household income. The remaining 20 per cent is secondary income, which includes social assistance benefits and workers compensation. Gross income is transformed into net income by the subtraction of tax paid by households. All series are seasonally adjusted real price terms and quoted in $million.

Income generated from household wealth has been excluded in the measure of labour income. Income from household wealth, including rental, interest and dividend income, reflects the return on household wealth rather than labour income. Therefore it has been excluded to enable an accurate measurement of the wealth effect.[13]

Net Wealth

Net Wealth has been divided into housing wealth and financial wealth. Housing wealth is equal to total housing assets minus mortgage debt, and financial wealth equal to total financial assets minus non-mortgage debt.

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[12] Employer's contribution to superannuation has been excluded from the measure of income, but enters the empirical estimation via the financial wealth variable. The rationale for the exclusion of superannuation is that labour income measures disposable income rather than total income.

[13] Income derived from wealth accounts for around 23 per cent of total household income.

Table 1: Components of Household Wealth

	1988	1995	2002
Share of the Total Household Wealth (%)			
Housing	57.2	56.8	59.9
Financial	42.8	43.2	40.1
direct equity	7.3	6.0	7.5
cash	12	11.0	9.1
superannuation	18.8	22.2	20.7
other financial	4.8	4.2	2.8
Debt as a Share of Total Asset (%)			
Debt	17.3	27.5	36.4
mortgage debt	11.8	22.9	31.3
other debt	5.5	4.6	5.1

Source: RBA, REIQ

Consumption Deflator

All series have been transformed into real terms using the household consumption expenditure deflator sourced from Table 9, ABS 5206, Australian National Accounts. The quarterly household consumption deflator is based at 100 in 2000/01.

Population

All series are transformed into per capita terms using the estimated Australian population, sourced from the quarterly Estimated Residential Population, Table 4, ABS 3101, Australian Demographic Trends. The March quarter 2003 observation was extrapolated from existing data.

Unit Root and Cointegration Tests

A number of tests are conducted to examine the properties of the time series data before estimating the consumption functions. Since these tests become fairly standard nowadays, only the conclusions are reported here.

Firstly, the null hypothesis of a unit root cannot be rejected at the 5 per cent confidence level for any of the variables. It is therefore concluded that consumption, income and net wealth variables are non-stationary time series. The results of Augmented Dickey Fuller tests further suggested that all these variables are integrated of order one.

Secondly, a Johansen trace test identified that, at 10 per cent confidence level, one cointegrating vector existed between the consumption, income, housing and financial wealth. The result was reconfirmed with Phillips-Perron cointegration tests at the 10 per cent confidence level. Based on the acceptance of the cointegrating hypothesis, the variables enter the long-run models in levels, rather than in differences.

4. Econometric Modelling

Long-run model

The long-run relationship between consumption, income and net wealth (and its components) is estimated using the Dynamic Ordinary Least Squares (DOLS) technique and the Dynamic Generalised Least Squares (DGLS) technique. The procedure, originally proposed by Stock and Watson (1993), has been used in previous studies to estimate consumption functions.

For systems of I(1) variables, the DOLS/DGLS procedure involves regressing the variable of interest on the contemporaneous levels of the remaining variables and the

leads and lags of their first difference. In the case of I(1) variables and a single cointegrating vector, the estimators are asymptotically equivalent to the Johansen estimator. Stock and Watson (1993) show that based on Monte Carlo simulations experiments, the associated confidence intervals of the estimators are preferable compared with the asymptotically efficient OLS/GLS estimators. Given the small sample size used in the estimation in this study, the more efficient DOLS/DGLS estimator is preferable.

The constant term has been omitted, i.e. restricted to zero, from the long-run models based on theoretical considerations. The inclusion of the constant term would suggest that in the long run, consumption can be positive even if income and net wealth are zero. Clearly this is inappropriate unless households consume out of some unmeasured income. Given consumption theory proposes that the level of long-run consumption is a function of income and net wealth only, and both of these variables are fully captured by the data set, it would be inconsistent to include a constant term in the long-run models. By excluding the constant term, consumption is restricted to zero when income and net wealth equal zero.[14]

[14] The robustness of this specification is tested by modelling the three alternative long-run relationships with a constant term. The value of the constant coefficient is found to be extremely large relative to the exogenous variables' coefficient values, and consequently resulted in statistical insignificance of both income and net wealth, which would suggests that income and net wealth do not affect long-run consumption. Clearly this is a counter-intuitive conclusion.

The consumption function estimated via the DOLS/DGLS is:

$$c_t = \alpha y_t + \beta h_t + \gamma f_t + \sum_{j=-2}^{2} (\phi_j \Delta y_{t+j} + \delta_j \Delta h_{t+j} + \rho_j \Delta f_{t+j}) + \varepsilon_t \quad (1)$$

where consumption, income, housing wealth and financial wealth are represented by c, y, h and f respectively, and ε is the error term.[15]

Table 2: Long-Run Consumption Function

$$c = \alpha y + \beta h + \gamma f$$

	DOLS	DGLS
y	0.847*	0.866*
	(0.0120)	(0.0134)
h	0.018*	0.015*
	(0.0018)	(0.0029)
f	0.004*	0.005#
	(0.0018)	(0.0030)
DW	0.9656	1.7959
SSE	37.325	28.512
LF	-289.392	-273.657

* denotes significance at the 95 per cent confidence level.
\# denotes significance at the 90 per cent confidence level.
Figures in the parentheses are standard error.

All coefficients are of expected signs and significant at the 5 per cent level with the exception of the financial wealth coefficient in the DGLS model, which is significant at the 10 per cent level.[16] A joint test for the significance of both the financial wealth and housing wealth in the DGLS model reveals that they are highly significant. The

[15] The estimation includes leads and lags of order two. Greater than two lags were found to be statistically insignificant.

parallel movement of the financial wealth and housing wealth series suggest there may be a degree of co-linearity between the two in the long-run. Other empirical studies have found that an estimation of the disaggregated form of the consumption function often results in one of the two wealth variables statistically insignificant.[17]

The coefficients α, β and γ can be interpreted as the (quarterly) marginal effect on long run consumption resulting from a change in income, housing wealth or financial wealth. The wealth effect associated with housing wealth is significantly greater than that associated with financial wealth. Specifically, a one dollar rise in housing wealth leads to a quarterly increase in consumption of between 1.5 cents and 1.8 cents, about 3 to 4.5 times of the effect of a one dollar rise in financial wealth.

A hypothesis test was conducted to determine if the wealth effect associated with housing wealth is the same as that of financial wealth, i.e. $\beta = \gamma$. The hypothesis was rejected at the 5 per cent confidence level for both the DOLS and DGLS results. It implies that households treat a one dollar rise in housing wealth differently from that of a one dollar rise in financial wealth.

Our findings are broadly consistent with those of IMF (2003) for a number of industrialised economies with comparable financial market characteristics, including Canada, Ireland, the Netherlands, Sweden, the UK, and the US. Interestingly, these countries have also experienced strong upswing in housing prices in recent years. Using a panel data set of these countries plus Australia over the period of 1984-2000,

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[16] The significance of financial wealth variable is particularly sensitive to the data period used. For example, if the first observation is excluded form the estimation, the financial wealth variable becomes significant at the 5 per cent level.

[17] For a more detailed explanation see Dvornak and Kohler (2003).

the IMF study found that household consumption increases by 7 cent for a dollar rise in housing wealth, and by 4.3 cent for a dollar rise in equity wealth.[18] Similarly, in studying both a panel data of 14 industrialised countries and a panel of US states, Case et al (2001) found that the effect of housing wealth is much stronger than financial wealth.

On the other hand, Tan and Voss (2003) registered a similar financial wealth effect of 4 cent to 5 cent, but an either negative or insignificant non-financial wealth effect. Senhadji *et al.* (2003) recorded that the effect of housing wealth is only half of that of financial credit. Likewise, Dvornak and Kohler (2003) found the effect of stock market wealth is two to three times that of housing wealth.[19] The stark difference between their findings and ours is likely due to the different methods of allocating debt across wealth components and the alternative estimation procedures.[20]

An explanation for the greater wealth effect associated with housing wealth than with financial wealth is that financial asset prices are in general more volatile than house prices, so households may find it more difficult to assess whether a change in financial wealth is permanent or temporary. Nevertheless, the fact that such a result is registered in long run models casts some doubt on this argument. A more plausible explanation is

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[18] While the model specifications of the IMF study is very similar to that in this paper, the use of data is very different. Besides using panel annual data, it used stock market capitalization as a ratio of GDP to proxy equity wealth and real house prices to proxy housing wealth.

[19] But they argued that as housing wealth is about three times the size of stock equity wealth, a one per cent increase in housing wealth has at least the same effect of a one per cent increase in stock market wealth.

[20] Tan and Voss allocated debt to asset types based on the asset-specific share of total assets held. In contrast, this study uses a more direct method of allocating debt across asset types by offsetting housing assets against debt held as mortgage related debt and offsetting non-housing assets against non-mortgage debt. While there remain potential misrepresentations given the increasing popularity of equity withdrawal to fund non-housing related spending, this construction method more accurately measures net housing asset. Dvornak and Kohler use the same methodology of allocating debt as Tan and Voss.

that the ownership of financial wealth is typically more concentrated in the more affluent group of the population than that of housing wealth. And this group's consumption is probably less responsive to asset price movement. Furthermore, house purchases are generally largely financed with mortgage loan, while financial asset purchases are not. As a result, a rise in house prices will present a greater investment return to households than an equal percentage change in, say, equity prices (IMF 2002).

The last explanation, plus the presence of large transaction costs, implies that the return rate of housing investment can not be computed simply from price changes. Yet, the results in Table 2 can be used to provide a rough estimation of this return rate. Suppose every one dollar of housing wealth generates a return of r dollars per quarter. Assuming that the marginal propensity to consume out of this wealth income is the same as that out of labour income, we obtain $r = \beta / \alpha$. Substituting the DGLS coefficient values into this formula gives $r = 0.015/0.866 = 0.017$. Translating this into annual terms, the return rate of housing investment is equal to $(1.017)^4 - 1 = 0.071$ or 7.1 per cent over the data sample. Using the coefficient values from the DOLS model will generate a value of 8.8 per cent.[21]

Our empirical findings, along with those of various international studies, suggest that sharp movement in house prices is potentially more disruptive than a corresponding movement in financial asset prices. This calls for different policy strategies in dealing with abrupt price movements in different asset markets. More specifically, policy

[21] Applying the same calculation to financial wealth will show that its effective return rate is only between 1.9 per cent (DOLS) and 3.1 per cent (DGLS), far below that of housing wealth.

makers may need to take action more swiftly in confronting rising house prices than rising share prices.[22]

The standard error of the estimate and the log-likelihood function of the long run model above indicate that the DGLS estimators are preferable to the DOLS estimators. Consequently, the short-run model presented next is based on the DGLS results.

Short-run model

The short-run model is an error correction model based on the long-run cointegrating relationship discussed above. Given the likelihood of endogeneity between the variables, instrumental variables were employed. The instrumental variables included the lagged differences of US household income and US household wealth and lagged values of income and net wealth.

The short-run model is:

$$\Delta c_t = \kappa + \sigma ECT_{t-1} + \sum_{j=0}^{2} (\chi_j \Delta y_{t-j} + \theta_j \Delta h_{t-j} + \zeta_j \Delta f_{t-j}) + e_t \qquad (2)$$

where κ is a constant term, ECT the error correction term and e the error term. The ECT is based on the DGLS result where $ECT = c - 0.866y - 0.015h - 0.005f$, and the coefficient, σ, can be interpreted as the speed of reversion toward the long-run equilibrium. The model is estimated using two lagged differences[23] of income and net

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[22] The approaches taken by the RBA and its US counterpart in dealing with asset price bubbles seem to fit this analysis. In dealing with the bubbles in the housing market, the RBA seemed more pro-active by, first, trying to talk down property market booms during early 2003 and, then raised interest rates. In contrast, the Federal Reserve Bank seemed to prefer to wait till the 2000 financial asset price bubble burst and subsequently lowered interest rates to revise the economy.

[23] Greater than two lagged terms was tested, however were statistically insignificant.

wealth to capture any persistence in the adjustment of consumption to changes in income and net wealth.

Table 3: Short-Run Consumption Function

Variable	Coefficient value (standard error)
ECT_{t-1}	-0.330 (0.153)
Δy_t	0.770 (0.063)
Δy_{t-1}	0.031 (0.062)
Δy_{t-2}	0.027 (0.063)
Δh_t	0.011 (0.003)
Δh_{t-1}	-0.002 (0.003)
Δh_{t-2}	-0.005 (0.003)
Δf_t	0.020 (0.007)
Δf_{t-1}	-0.001 (0.008)
Δf_{t-2}	0.002 (0.009)
constant	11.192 (7.432)

The short-run model coefficients can be interpreted in a similar way to the long-run model coefficients. A one dollar change in income results in a 77 cent change in consumption in the first period, followed by a (insignificant) 3 cent rise in consumption in the second and third periods respectively.[24] The housing wealth and financial wealth coefficients can be interpreted in a similar way.

[24] The vast majority of the income effect is captured within the current period and the two-period lag. Therefore, the difference between the sum of the short-run income coefficients and the long-run income coefficient is the ongoing effect of income beyond the two-period lag.

Interestingly, according to the data sample the effect on consumption from a change in housing wealth is largely captured in the first period (the short run effect of 0.011 compared with the long-run effect of 0.015). In contrast, only around half of the total change in consumption that flows from a change in financial wealth is capture in the period immediately following the movement in financial wealth. This likely reflects the fact that households perceive greater uncertainty in reading the persistence in the financial asset price movement compared to that in house price movement.[25]

Lastly, a hypothesis test could not reject that the short-run effect of housing wealth on consumption is the same as that of financial wealth, i.e. $\theta_0 = \zeta_0$, in contrast to the long-run result.

The error correction term in the short-run models indicate the speed at which an out-of-equilibrium system adjusts back to the long-run equilibrium. Our finding of around 30 per cent adjustment per quarter is comparable to the 25 per cent to 50 per cent in IMF (2002), but much higher than the 5 per cent in Tan and Voss (2003). The difference is likely due to the deployment of different consumption components. In particular, the inclusion of durable goods consumption is likely to make the adjustment much quicker.[26]

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[25] The coefficient associated with the second lagged difference of financial wealth is large and significant. This potentially suggests that consumption may react to financial assets prices after a time lag in which the household becomes less uncertain of the sustainability of the rise in financial asset prices.

[26] For example, a household that enjoys a windfall capital gain would be likely to increase their consumption of durable goods more quickly than increasing their consumption of non-durables. Due to the high costs of durable goods, consumption and income will tend to realign relatively quicker.

Simulation of Housing Price Realignment

This section is devoted to conducting a policy experiment to determine the effect of an adjustment in Australian house prices on household consumption. In doing so, the quantum of the current over-valuation in property prices relative to the historical average has been measured via a long-run average price-to-rental (PR) and a long-run trend PR ratio value ratio, using median house prices and average rental yields. The required adjustment in house prices is then applied to the short-run consumption function above to quantify the macroeconomic effect.[27]

Housing data were obtained from the Housing Institute of Australia and the Real Estate Institute of Australia. The long-run average PR ratio over the data sample, as shown in Figure 2, is 16.9, i.e. the house price is on average 16.9 times the average annual rental earnings. The September quarter 2003 PR ratio was calculated at 32.2. Therefore, the ratio of house prices to rental income would need to fall by 47.5 per cent to re-align with the average PR ratio value over the data sample.

Because rental prices are assumed fixed in this policy experiment the movement required to realign the PR ratio to the average value can be as the required house price movement.[28]

A more plausible policy experiment scenario, however, is one in which the PR ratio has been trending higher due to factors raised previously. If the steady state PR ratio has

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[27] The effect of insignificant short-run model variables has been excluded from the policy experiment estimation.

[28] Any adjustment toward a steady state PR ratio would almost certainly involve both house price falls and rent price increases. For simplicity, this policy experiment assumes rental prices stay constant during the annual house price realignment.

changed due to structural adjustment,[29] the current PR ratio of 32.2 should be compared with a linear trending PR ratio value of 25.4 for the September quarter 2003. Under this scenario, a downward adjustment of the house price to rental ratio of 21.1 per cent would be required to revert back to the trend PR ratio.

Table 4 records the results of combining the experimental fall in house prices derived from the PR ratio analysis, with the short run consumption function estimated in the previous section. In the first scenario, where house prices fall 47.5 per cent to realign with the long-run average PR ratio valuation, annual per capita consumption is estimated to fall by $574 or 10.6 per cent. In aggregate terms, annual consumption falls by around $11.4 billion. In the second scenario, where a 21.1 per cent fall in house prices realigns the PR ratio to the trend PR value, the fall in per capita consumption is estimated to be $238, while in aggregate terms, consumption falls by $4.7 billion.[30]

Table 4: Macroeconomic Effect of Housing Price Realignment

	(1) Average PR - House price fall of 47.5%	(2) Trend PR - House price fall of 21.1%
Annual movement in per capita housing wealth ($)	-$47,126	-$20,934
Effect on per capita consumption after one year ($)	-$574	-$238

[29] Structural adjustment could potentially result from a change in underlying interest rates or investment taxation policy treatment for example.

[30] Although this policy experiment extracts from the impact of the fall on the supply side of the economy, a substantial fall in house prices would have adverse effects on employment in construction and related industries. Also, financial institutions that have large exposure to mortgage loans may be required to tighten their lending. According to the Australian Prudential and Regulatory Authority (APRA), which conducted a stress test simulating a 30 per cent fall in house prices on 120 authorised deposit-taking institutes (ADIs), none of the ADI's would fail or come close to failing. For details about the APRA stress test, see Laker (2003).

Adjustment as a share of annual consumption (%)	10.6%	4.1%

Source: Author's own calculation

The macroeconomic effect of the house price adjustment scenario is highly dependent on the fundamental value toward which house prices will adjust. The 47.5 per cent house price fall is more the worst scenario than the most likely one. Notwithstanding, severe asset prices adjustments are susceptible to overshoot. In this sense, even if one assumes the trending PR ratio scenario of a 21.1 per cent house price correction is a more plausible scenario, the average PR ratio correction is useful in providing an upper bound estimation.

5. Conclusion

This study examined the effects of housing wealth and financial wealth on household consumption using Australian data for the period Q2:1988-Q1:2003. It was found that a one dollar permanent increase in housing wealth will result in a six cent rise in annual household consumption in the long run, three times the effect of an equal increase in financial wealth. The result speaks strongly against the assumption of assets fungibility. More importantly, the findings imply that a sharp movement in house prices is potentially more disruptive than a corresponding movement in financial asset prices. This calls for different levels of policy attention in dealing with abrupt price movements in different asset markets.

The policy implication of the empirical estimation was further studied through simulating the effect on household consumption of a realignment of house prices back to their fundamental values. An average PR ratio and a linear trending PR ratio are

used, respectively, as a benchmark of fundamental housing prices. It is found that using this data sample, the ratio of house prices to rental income would need to fall by around 21.1 per cent (and as a worst case, up to 47.5 per cent) to realign with historical valuations. This translates into a drop in annual household consumption by 4.1 per cent (or as a worst case, up to 10.6 per cent).

The simulation results indicate that the impact of any realignment of housing prices crucially depends on the scale and duration of price adjustment. In this regard, recent statistics show that the growth of house prices in Australia has slowed, and in some cases, particularly for inner-city apartments in Sydney and Melbourne, have even declined. Continuous falls in housing finance since the Reserve Bank raised cash rate twice in late 2003 further confirms the property market boom has been losing steam. Such anecdotal evidence seems to suggest that, to date, the housing market correction has been gradual, mitigating the likelihood of vast macroeconomic ramifications.

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Appendix A: Alternate Model Specifications

In addition to the model presented in detail above, a number of alternate long-run consumption function specifications were tested.

Alternate Model A

Alternate model A is a traditional consumption function specification where total wealth influences the household consumption decisions. Total net wealth (w) is equal to the households' total asset minus total debt, or equivalently net housing wealth plus net financial wealth.

Table A.1: Alternate Model A

$$c = \alpha y + \beta w$$

Variable	Coefficient value (standard error)	
	DOLS	DGLS
y	0.905* (0.023)	0.875* (0.044)
w	0.009* (0.001)	0.010* (0.002)
DW	0.568	1.608
SSE	52.153	29.642
LF	-314.416	-281.187

* denotes significance at 95 per cent confidence

The estimated marginal propensities to consume out of labour income are comparable to those in section 4. For both DGLS and DOLS, the estimated marginal propensities

to consume out of total wealth, as expected, lay between those of net financial wealth and housing wealth.

Alternate Model B

Alternate model B generalises the consumption function by disaggregating financial wealth into superannuation assets (s) and net other financial wealth (of). This is to test whether superannuation assets have different long-run wealth effect from other financial assets. Differences may arise from the fact that superannuation assets are very illiquid but receive more favourable tax treatments.

Table A.2: Alternate Model B

$$c = \alpha y + \beta h + \gamma of + \psi s$$

Variable	Coefficient value (standard error)	
	DOLS	DGLS
y	0.881* (0.022)	0.912* (0.047)
h	0.017* (0.002)	0.015* (0.003)
of	-0.021 (0.011)	-0.027 (0.020)
s	0.019* (0.007)	0.023# (0.012)
DW	1.0613	2.0148
SSE	27.926	27.904
LF	-280.909	-266.504

* denotes significance at the 95 per cent confidence level
# denotes significance at the 90 per cent confidence level

With the exception of γ, all coefficients are significant at the 5 per cent significance level. The income effect is in line with expectations and previous estimations. The relatively stable income relationship provides confidence in the estimation of the income effect across consumption functions. Likewise, the coefficient assigned to housing wealth is similar to that estimated previously, and is highly significant in both alternately specified models.

The negative sign on γ raises some concerns. On theoretical grounds it is difficult to justify why other net financial wealth has a negative relationship with consumption. The most likely reason for the negative sign is the co-linearity between other net financial wealth and superannuation wealth. Intuitively this makes sense given superannuation assets are generally held in financial assets that are predominately equities and cash related.

Further Model Testing

In addition to alternate models A and B, a number of other specifications were examined in order to test a range of hypotheses. Although these did not have sufficient statistical power to be worth reporting in detail, they do raise a number of questions and provide potential extensions for future research. An alternative long-run model specification is that consumption is a function of income, and separately, assets and debt (in contrast to net wealth). This tests the assumption that the effect on consumption from a rise in asset value is the same (in absolute terms) as a rise in debt. If the coefficients are found to be statistically equal then it is appropriate to use the net wealth specification, however if the coefficients statistically differed, then net wealth would be a misspecification. The hypothesis test could not reject that the effect on

consumption from a rise in assets is offset by an equal rise in debt. It makes intuitive sense that in the long-run this must be the case. For example, if the household consumed more from a rise in assets than the corresponding fall in consumption from a rise in debt, then the household would have an incentive to continue to borrow indefinitely, and consumption would be unbound.

Another potential consumption function specification which included the interest rate term was tested to examine the effect, if any, the interest rate had on either the long-run or short-run estimators. There was insufficient empirical evidence to support this hypothesis. Moreover, an interaction term of the interest rate multiplied by the level of debt was included to test if households' repayment obligation, especially if they are liquidity-constrained, caused any change in the wealth or income effect. Likewise, this was found to be insignificant at a standard level of confidence.

An additional short-run test involved the inclusion of the median house price and separately, a housing affordability measure to attempt to capture any partially offsetting effect of house prices rises on non-home owners and potential future home owners. As house prices rise, home owners may increase consumption as their wealth rises, however those that do not own a house but have an intention to purchase one, may need to reduce their consumption to save for a deposit. This may give rise to an offsetting negative impact on consumption. However, the inclusion of the median house price and separately, the housing affordability variables were found to be statistically insignificant.